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# REPORT ON DETAILED AIRBORNE GEOPHYSICAL SURVEYING

**Floodwood Lake Property** 

Blakelock Twp. Larder Lake Mining Division

NTS: 42H/08

PROJ #602

FALCONBRIDGE LIMITED (formerly Noranda Inc.) February 17<sup>th</sup>, 2006



#### SUMMARY AND RECOMMENDATIONS

Detailed airborne electromagnetic and magnetic geophysical surveying was completed over Falconbridge Limited's (formerly Noranda Inc.) Floodwood Lake Property in Blakelock Twp., Larder Lake Mining Division. Surveying was completed by Geotech Ltd. between November 8<sup>th</sup> – 20<sup>th</sup>, 2004 over approximately 33 line km of surveying. The work was aimed at defining the location and quality of geophysical conductors previously identified on the property by a regional airborne survey.

The surveying defined a strong EM response with a directly coincident magnetic anomaly in the central portion of the survey area. The characteristics of the target are strongly suggestive of possible Cu-Zn sulphide mineralization and drill testing of this target is recommended. Other conductors on the property are considered lower priority targets. Magnetic anomalies defined on th grid may be related to intrusive rocks given their apparent discordance with the general trend of stratigraphy in the area. The exception is a small bulls-eye type magnetic high associated with the strong EM response described above.

## TABLE OF CONTENTS

SUMMARY AND RECOMMENDATIONS	.2
TABLE OF CONTENTS	. 3
INTRODUCTION, LOCATION & ACCESS	. 4
GENERAL GEOLOGY	. 6
PREVIOUS WORK	.7
GEOPHYSICAL SURVEY DESCRIPTIONS	. 8
MAGNETIC SURVEY RESULTS	. 8
EM SURVEY RESULTS	. 8
RECOMMENDATIONS	10
REFERENCES	11

#### APPENDICES

VTEM® Airborne Geophysical Survey Technical Specifications

## LIST OF MAPS

(Back Pocket)

- 1) Magnetic Survey Results (nT)
- 2) Airborne EM Survey (0.48ms time-gate)
- 3) Airborne EM Survey (3.18ms time-gate)
- 4) Airborne EM Survey (7.54ms time gate)

#### **INTRODUCTION, LOCATION & ACCESS**

Detailed airborne electromagnetic and magnetic (VTEM<sup>®</sup>) geophysical surveys were completed over a large area covering portions of Falconbridge Limited's (formerly Noranda Inc.) Floodwood Lake Property in Blakelock Twp., Larder Lake Mining Division. The work was aimed at defining the location and quality of several geophysical conductors previously identified on the property by a regional airborne survey.

The Floodwood Lake Property consists of a single 16 unit claim in southwestern Blakelock Twp. in the Larder Lake Mining Division (Fig. 1). The claim was recorded on Feb. 17<sup>th</sup>, 2004 and is registered to Falconbridge Limited. The property is located approximately 75km northeast of the town of Cochrane 5km east of Hwy 652 (Detour Lake Highway). Access to the property is possible via a logging road which turns east of Hwy 652 approximately 99 road km northeast of Cochrane. A single stream crossing permit from the Ministry of Natural Resources is required for the ground access route.

Claim	Township	Held	<b>Recording Date</b>	Due Date	Units
L3013102	Blakelock	Falconbridge Limited	Feb. 17, 2004	Feb. 17, 2006	16

Table 1 – Floodwood Lake Property Description

Approximately 33km of airborne surveying was completed over the Floodwood Lake Property by Geotech Ltd. of Aurora, ON between Nov.  $8^{th} - 20^{th}$ , 2004. Interpretation and reporting of the geophysical results were performed by Falconbridge staff.



Fig. 1 – Property Location and Access

#### **GENERAL GEOLOGY**

The most thorough and recent examination of the regional geology of the area was completed by G.W. Johns (1982). This portion of the Abitibi Greenstone Belt consists of east-west trending arcuate belts of mafic to felsic volcanic rocks which are intruded by several late granitc plutons. Thick sedimentary belts occur on the margins of the volcanic terraines and the volcanics themselves are intercalated with volumetrically minor amounts of detrital sedimentary rocks and iron formations (Fig. 2). Mafic volcanic rocks are interpreted to underlie the entirety of the property area although no outcrop is known to exist with it's extents. The closest bedrock exposures are located approximately 1.5km southeast of the property where a scattering of small outcrops of mafic volcanic rocks, diabase and felsic intrusive rocks occur. Historic drilling to the northeast and southeast of the claim area intersected similar lithologies. Drilling west of the property intersected thick sequences of sedimentary rocks with minor volcanics.



Fig. 2 – Regional Geology and Property Location

#### PREVIOUS WORK

A significant amount of historical work has been completed in the general area of the Floodwood Lake Property however very little has actually been performed in the immediate claim area. The majority of work was completed in the mid to late 1980's with more significant programs being undertaken by **Placer Dome** (1988-'89), **Chevron Minerals** (1989) and **Deerfoot Resources** (1986-'87). A summary of historic work available from the ERME's assessment work database is provided below. Bold entries indicate work completed in the specific area covered by the current Floodwood Lake Property.

AFRI File	Company	Year	Work 1	Work 2	Work 3	Work Report
42H09SE0026	Utah Mines	1982	EM	Magnetics		W8208-00171
42H08NE0022	Deerfoot Resources	1986	Geology			W8608-00337
42H08NE0024	Deerfoot Resources	1986	EM			W8608-00194
42H08NE0020	P. Bernier	1986	EM	GEOL	Magnetics	W8608-59877
42H09SE0018	Adola Mining	1987	Drilling			W8708-00213
42H09SE0017	Deerfoot Resources	1987	Drilling			W8708-00212
42H08NE0010	Placer Dome	1988	ĒM	Magnetics		W8808-00232
42H08NE0013	Placer Dome	1988	EM	Magnetics		W8808-00231
42H08NE0007	Chevron Minerals	1989	Geology			W8908-00217
42H08NW0006	Chevron Minerals	1989	Geochem	Magnetics		W8909-00076
42H09SE0014	Chevron Minerals	1989	Drilling			W8908-00001
42H08NE0006	Placer Dome	1989	Drilling			W8908-00233
42H08NE0011	Placer Dome	1989	Drilling			W8908-00040
42H09SE0015	Chevron Minerals		Drilling			n/a
42H09SE0031	Conwest Exploration		EM			n/a
42H08NE0015	Deerfoot Resources		Geochem	Prospecting		n/a
42H08NE0027	Geophysical Engineering		Drilling			n/a
42H08NE0028	Geophysical Engineering		Drilling			n/a
42H08NE0025	Hudson Bay Exploration & Development		EM			n/a
42H08NE0026	Hudson Bay Exploration & Development		EM			n/a
42H09SE0033	Noranda		EM	Magnetics		n/a
42H09SE0035	Noranda		Drilling			n/a

#### Table 2 – Summary of Historic Work (ERME's)

No drilling is known to have been completed within the property boundary but concentrated drilling has been performed to the northeast, southeast and west of the property. Adola Mining completed six DDH's northeast of the property along a strike length of approximately 1.6km. the drilling intersected predominantly mafic to intermediate volcanic rocks with minor intercalated sediments. Extensive drill programs by both **Deerfoot Resources** and **Placer Dome** were also mounted to the southeast of the grid. Lithologies intersected in this area were almost exclusively intermediate to mafic volcanics, again with only minor sediments and intrusive rocks. A small, two-hole drill program was also completed by **Chevron Minerals** approximately 2km west of the property. In this area, clastic and detritral sedimentary rocks were the dominant lithologies intersected with only subordinate amounts of volcanic stratigraphy.

#### **GEOPHYSICAL SURVEY DESCRIPTIONS**

The helicopter-borne VTEM<sup>®</sup> time-domain EM system was utilized to more closely evaluate and locate the EM targets. A rectangular survey area covering approximately 1.4km<sup>2</sup> was flown for a total of approximately 33 line km of surveying. The grid flown was oriented on a 003° bearing with a flightline spacing of 50m and a nominal 2.2km flightline length. The surveying was completed between November 8<sup>th</sup> – 20<sup>th</sup>, 2004. Details pertaining to the technical specifications of this survey are given in Appendix A.

#### MAGNETIC SURVEY RESULTS

The magnetic results for all three grids are contoured and presented on the maps in the back pocket of this report and summarized on Fig. 3. Three discreet magnetic high anomalies were defined within the survey area. **Mag 'A'** is a broad somewhat linear, north-south trending magnetic high in the northern half of the survey area. The anomaly has a maximum intensity of >57,500nT but has no clear EM association. The only significant EM response in the vicinity of the feature is a short, relatively weak, east-west trending conductor at it's northern extent **(EM 'A')**. Given the apparent east-west trend to stratigraphy in the area, it is likely that the magnetic anomaly is a result of an intrusive ultramafic or gabbroic body or a wide diabase dyke.

**Mag 'B'** is a partially defined feature on the northeastern limit of the survey area. The feature appears circular in form and has an intensity of at least 57,500nT. Again, the anomaly appears to have an indirect EM association with **EM 'B'** which trends across it's northwestern limit however any detailed description is tenuous due to the incomplete coverage over the anomaly.

**Mag 'C'** is a 'bulls-eye' type 57,5000nT magnetic high occurring to the southeast of the southern end of **Mag 'A'**. The feature is somewhat ovoid if form with a northeasterly trending long-axis. The anomaly has a complex EM response associated with it which is at least in part directly coincident with the magnetic feature suggesting a possible sulphide source to the feature.

#### EM SURVEY RESULTS

Electromagnetic anomalies are picked along line profiles of the data collected using the VTEM system. Electromagnetic anomalies defined from mid (3.18 ms) to high (>7.54 ms) timegates are typically associated with bedrock conductors as opposed to overburden responses. All anomalies shown on the Floodwood Lake Property in Fig. 3 are interpreted as bedrock conductors (circular symbols). Related anomalies are grouped and described collectively.

Anomalies **EM** 'A' and **EM** 'B' are both roughly east-west trending strings of conductors across the northern end of the surveyed grid. Although the two areas show a distinct break



Fig. 3 – Interpreted EM Anomalies and Contoured Total Field Magnetics

between them, the two trends may in fact be related but have been displaced due to faulting and/or intrusive activity. The trends show relatively good and uniform conductivity being apparent in the latest 7.54ms time-gate. As mentioned, both trends show indirect magnetic associations but are not perfectly coincident with the underlying magnetic anomalies.

**EM 'C'** is a complex EM response associated with a ovoid, 'bulls-eye' type magnetic anomaly (Mag 'C'). The conductor is composed of a strong, short strike length string of northeast trending anomalies with a weaker string of anomalies trending to the northwest, orthogonal to the stronger picks. The stronger trend, which is clearly visible on the 7.54ms time-gate and a short portion of it is coincident with the magnetic anomaly and shows a similar northeasterly trend. The two conductive trends suggest possible stringer mineralization below a more massive sulphide cap. The conductor has a steep orientation with a slight northward dip.

EM 'D' is another somewhat complex scattering of EM anomalies to the west of EM 'C'. It's characteristics are very similar to the northeast trending portion of EM 'C' except it lacks any significant magnetic association. As with EM 'A' and EM 'B' the two conductors may in fact be related but have been separated by faulting and/or intrusive activity.

#### RECOMMENDATIONS

The characteristics of EM 'C' and it's direct magnetic association make it a highly prospective target for possible Cu-Zn sulphide mineralization. As no outcrop is known in the area, drill testing of the EM response is recommended to evaluate the target. Pending the results, additional drill testing of EM 'D' may also be warranted. Conductors on the northern end of the grid are weaker in strength and show somewhat contradictory magnetic association making them lower priority areas for further work.

**Dean F. Rogers, P. 466.** Senior Project Geologist Falconbridge Limited (formerly Noranda Inc.)

#### REFERENCES

#### Johns, G.W.

1982: Geology of the Burntbush-Detour Lakes Area, District of Cochrane; Ontario Geological Survey Report 199, 82p. Accompanied by Map 2453, scale 1:100,000

#### Ontario Geological Survey

2003: Geological Compilation of the Abitibi Greenstone Belt – Digital Data, Ontario Geological Survey MRD 143, scale 1:250,000

#### ERMES MNDM Website

Various assessment files

# Appendix A

VTEM<sup>®</sup> Airborne Geophysical Survey Technical Specifications

Geotech Ltd.

# REPORT ON A HELICOPTER-BORNE TIME DOMAIN ELECTROMAGNETIC GEOPHYSICAL SURVEY

La Sarre Blocks, Quebec, Canada

for Noranda Inc.

# By

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Survey flown in November, 2004

Project 490 December, 2004

## TABLE OF CONTENTS

Executive Summary	3
1. INTRODUCTION	4
1.1 General Considerations	4
1.2. Survey and System Specifications	4
1.3. Data Processing and Final Products	4
1.4. Topographic Relief	5
2. DATA ACQUISITION	6
2.1. Survey Areas	6
2.2. Survey Operations	6
2.3. Flight Specifications	7
2.4. Aircraft and Equipment	9
2.4.1. Survey Aircraft	9
2.4.2. Electromagnetic System	9
2.4.3. Airborne magnetometer	10
2.4.4. Ancillary Systems	10
2.4.5. Base Station	11
3. PERSONNEL	12
4. DATA PROCESSING AND PRESENTATION	13
4.1. Flight Path	13
4.2. Electromagnetic Data	13
4.3. Magnetic Data	13
5. DELIVERABLES	14
5.1. Survey Report	14
5.2. Maps	14
5.3. Gridded Data	14
5.4. Digital Data	14
6. CONCLUSIONS	

#### APPENDIX

	Α.	SURVEY	AREAS	LOCATION MAP
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# REPORT ON A HELICOPTER-BORNE TIME DOMAIN ELECTROMAGNETIC SURVEY

La Sarre Blocks, Quebec, Canada

# **Executive Summary**

During the period of November 8<sup>th</sup> to 20<sup>th</sup>, 2004, Geotech Limited carried out a helicopter-borne geophysical survey for Noranda Inc. over twenty one (21) blocks near La Sarre, Quebec.

Principal geophysical sensors included a time domain electromagnetic system (VTEM) and a cesium magnetometer. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 790.4 line-km were flown.

In-field data processing involved quality control and compilation of data collected during the acquisition stage, using the in-field processing centre established at La Sarre. Preliminary and final data processing, including generation of final digital data products were done at the office of Geotech Limited in Aurora, Ontario.

The processed survey results are presented as two (2) grids and digital profile data for each block. The grids are:

- Total Field Magnetics.
- Time Gate 3.18 miliseconds.

Profile data includes all electromagnetic and magnetic products plus positional, altitude and raw data.

# 1. INTRODUCTION

### 1.1 General Considerations

These services are the result of the Agreement made between Noranda Inc. and Geotech Limited, to perform a helicopter-borne geophysical survey over twenty one (21) blocks near La Sarre, Quebec. 790.4 line-km of geophysical data were acquired during the survey.

Mr. Michel Allard acted on behalf of Noranda Inc. during data acquisition and processing phases of this project.

The survey blocks are as shown in the Location map in Appendix A.

The crew was based in Mot Villa Repos Motel at La Sarre for the acquisition phase of the survey, as shown in Section 2 of this report.

The helicopter was based at the Abitibi Helicopters base located in La Sarre. Survey flying was completed on November 20<sup>th</sup>, 2004. Preliminary data processing was carried out daily during the acquisition phase of the project. Final data presentation and data archiving was completed in the Aurora office of Geotech Limited by December, 2004.

## 1.2. Survey and System Specifications

The survey blocks were flown with a nominal traverse line spacing of 50 metres.

Where possible, the helicopter maintained a mean terrain clearance of 75 metres, which translated into an average height of 30 meters above ground for the bird-mounted VTEM system and 60 meters above ground for the magnetic sensor.

The survey was flown using an Astar BA+ helicopter, registration C-GHSM, operated by Abitibi Helicopters Ltd. Details of the survey specifications may be found in Section 2 of this report.

## 1.3. Data Processing and Final Products

Data compilation and processing were carried out by the application of Geosoft OASIS Montaj and programs proprietary to Geotech Limited. Maps, profile data and fourty two (42) grids of final products were presented to Noranda Inc.

The survey report describes the procedures for data acquisition, processing, final image presentation and the specifications for the digital data set.

## 1.4. Topographic Relief

The twenty one (21) blocks are located approximately 32 - 110 kilometers NW of La Sarre.

Topographically, elevation range from 250 metres to 350 metres above sea level.

The blocks intersect lakes and rivers.

Some blocks have road access.

# 2. DATA ACQUISITION

## 2.1. Survey Areas

The survey blocks (see location map, Appendix A) and general flight specifications are as follows:

	Line	A 117 2		Flight	
BIOCK	spacing (m)	Area (Km <sup>-</sup> )	Line-km	direction	Line number
ADR-08	50	1.6	32.3	N0°E	L1000 - 1070
ABB-09a	50	1.7	32.3	N33.3°E	L1100 - 1170
BRA-09	50	5.4	105.0	N40.28°E	L1200 - 1315
Block 14	50	1.7	32.8	N1.97°E	L1400 - 1470
BLA-13	50	1.7	32.5	N13.36°W	L1500 - 1570
BLA-10	50	1.7	33.1	N13.35°W	L1600 - 1670
BLA-06	50	1.7	32.8	N8.4°W	L1700 - 1770
BLA-03	50	1.7	33.4	N17.83°E	L1800 - 1870
HOB-0304	50	2.2	44.4	N10.64°E	L1900 - 1995
BLA-18	50	1.5	30.8	N17.76°E	L2105 - 2170
HUR-02	50	1.7	32.3	N26.1°W	L3000 - 3070
HUR-03a	50	2.3	43.8	N26.12°E	L3100 - 3195
NOS-09	50	2.1	41.5	N0°E	L3300 - 3390
HUR-10	50	1.9	37.0	N1.46°W	L3500 - 3580
NOS-02	50	1.7	32.3	N9.42°W	L3700 - 3770
ENJ-03	50	1.7	32.5	N19.75°E	L3900 - 3970
ATK-22	50	1.7	32.2	N25.94°E	L4100 - 4170
ATK-21	50	1.7	32.3	N55.81°E	L4300 - 4370
MSS-04	50	1.7	32.1	N0°E	L4500 - 4570
LDL-01	50	1.7	32.4	N11.76°E	L4700 - 4770
LDL-13	50	1.7	32.4	N28.7°W	L4900 - 4970

Table 1 – Survey blocks

# 2.2. Survey Operations

Survey operations were based in Mot Villa Repos Motel, in La Sarre from November 8 to 20, 2004 for the acquisition phase of the survey.

The following table shows the timing of the flying.

Date	Crew Location	Flight #	Km flown	Comments
	Mot Villa Repos Motel,			
8-Nov	La Sarre			Crew mobilization.
	Mot Villa Repos Motel,			
9-Nov	La Sarre			System installation.
	Mot Villa Repos Motel,			
10-Nov	La Sarre			System installation.
	Mot Villa Repos Motel,			
11-Nov	La Sarre			Test flights.
	Mot Villa Repos Motel,			
12-Nov	La Sarre	1, 2	118.4	
	Mot Villa Repos Motel,			
13-Nov	La Sarre	3, 4	120.2	
	Mot Villa Repos Motel,			
14-Nov	La Sarre	6, 7	194.3	
	Mot Villa Repos Motel,			
15-Nov	La Sarre	8	83.7	
	Mot Villa Repos Motel,			
16-Nov	La Sarre	9, 10, 11	78.1	
	Mot Villa Repos Motel,			Rain, low ceiling.
17-Nov	La Sarre			Stand by.
	Mot Villa Repos Motel,			Rain, low ceiling.
18-Nov	La Sarre			Stand by
	Mot Villa Repos Motel,			
19-Nov	La Sarre	12	4.4	
	Mot Villa Repos Motel,			
20-Nov	La Sarre	13, 14, 15	191.4	
Total			790.4	

Table 2 – Survey schedule

## 2.3. Flight Specifications

The nominal EM sensor terrain clearance was 30 m (EM bird height above ground, i.e. helicopter is maintained 75 m above ground). Nominal survey speed was 80 km/hour. The data recording rates of the data acquisition was 0.1 second for electromagnetics and magnetometer, 0.2 second for altimeter and GPS. This translates to a geophysical reading about every 2 metres along flight track. Navigation was assisted by a GPS receiver and data acquisition system, which reports GPS co-ordinates as latitude/longitude and directs the pilot over a pre-programmed survey grid.

The operator was responsible for monitoring of the system integrity. He also maintained a detailed flight log during the survey, tracking the times of the flight as well as any unusual geophysical or topographic feature.

On return of the aircrew to the base camp the survey data was transferred from a compact flash card (PCMCIA) to the data processing computer.

# 2.4. Aircraft and Equipment

# 2.4.1. Survey Aircraft

An Astar BA+ helicopter, registration C-GHSM - owned and operated by Abitibi Helicopters Ltd. was used for the survey. Installation of the geophysical and ancillary equipment was carried out by Geotech Ltd.

## 2.4.2. Electromagnetic System

The electromagnetic system was a Geotech Time Domain EM (VTEM) system. The layout is as indicated in Figures 1 below.





Figure 1

Receiver and transmitter coils were concentric and Z-direction oriented. Transmitter coil diameter was 26 metres, the number of turns was 4. Receiver coil diameter was 1.1 metre, the number of turns was 60. Transmitter pulse repetition rate was 30 Hz. Peak current was 200 A. Duty cycle was 40%. Peak dipole moment was 425000 NIA. Wave form – trapezoid. Twenty-five measurement gates were used in the range from 130 µs to 6340 µs. The transmitter waveform and the receiver decay recording scheme is shown diagrammatically in Figure 2. Recording sampling rate was 10 samples per second. The EM bird was towed 45 m below the helicopter.

#### 2.4.3. Airborne magnetometer

The magnetic sensor utilized for the survey was a Geometrics optically pumped cesium vapor magnetic field sensor, mounted in a separate bird towed 15 m below the helicopter. The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds. The magnetometer sends the measured magnetic field strength as nanoTeslas to the data acquisition system via the RS-232 port.

## 2.4.4. Ancillary Systems

#### 2.4.4.1. Radar Altimeter

A Terra TRA 3000/TRI 30 radar altimeter was used to record terrain clearance. The antenna was mounted beneath the bubble of the helicopter cockpit.

#### 2.4.4.2. GPS Navigation System

The navigation system used was a Geotech PC based navigation system utilizing a NovAtel's WAAS enable OEM4-G2-3151W GPS receiver, Geotech navigate software, a full screen display with controls in front of the pilot to direct the flight and an NovAtel GPS antenna mounted on the helicopter tail. The co-ordinates of the block were set-up prior to the survey and the information was

The co-ordinates of the block were set-up prior to the survey and the information was fed into the airborne navigation system.

### 2.4.4.3. Digital Acquisition System

A Geotech data acquisition system recorded the digital survey data on an internal compact flash card. Data is displayed on an LCD screen as traces to allow the operator to monitor the integrity of the system. Contents and update rates were as follows:

<b>DATA TYPE</b>	SAMPLING
TDEM	0.1 sec
Magnetometer	0.1 sec
GPS Position	0.2 sec
RadarAltimeter	0.2 sec

Table 3 - Sampling Rates

#### 2.4.5. Base Station

A combine magnetometer/GPS base station was utilized on this project. A Geometrics Cesium vapour magnetometer was used as a magnetic sensor with a sensitivity of 0.001 nT. The base station was recording the magnetic field together with the GPS time at 1 Hz on a base station computer. The base station magnetometer sensor was installed near the Abitibi Helicopters base, away from electric transmission lines and moving ferrous objects such as motor vehicles. The magnetometer base station's data was backed-up to the data processing computer at the end of each survey day.

# 3. PERSONNEL

The following Geotech Ltd. personnel were involved in the project.

Field

Geophysicist/Crew Chief: Operator:

Shawn Grant Claude Berthelot

The survey pilot and the mechanic were employed directly by the helicopter operator – Abitibi Helicopters Ltd.

Pilot:

Joel Breton

Office

Data Processing: Data Processing/Reporting: Andrei Bagrianski Marta Orta

Final data processing at the office of Geotech Limited in Aurora, Ontario was carried out under the supervision of Andrei Bagrianski, Data Processing Manager.

Overall management of the survey was carried out from the Aurora offices of Geotech Ltd. by Edward Morrison, President.

# 4. DATA PROCESSING AND PRESENTATION

## 4.1. Flight Path

The flight path, recorded by the acquisition program as WGS 84 latitude/longitude, was converted into the UTM co-ordinate system in Oasis Montaj.

The flight path was drawn using linear interpolation between x,y positions from the navigation system. Positions are updated every second and expressed as UTM eastings (x) and UTM northings (y).

# 4.2. Electromagnetic Data

A three stage digital filtering process was used to reject major sferic events and to reduce system noise. Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. Smoothing or stacking will reduce their amplitude but leave a broader residual response that can be confused with geological phenomena. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events. The filter used was a 16 point non-linear filter.

The signal to noise ratio was further improved by the application of a low pass linear digital filter. This filter has zero phase shift which prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 1 second or 20 metres. This filter is a symmetrical 1 sec linear filter.

The results are presented as EM Time Gate 3.18 milisecond grid, from the channel located 3 miliseconds after the termination of the impulse.

# 4.3. Magnetic Data

The processing of the magnetic data involved the correction for diurnal variations by using the digitally recorded ground base station magnetic values. The base station magnetometer data was edited and merged into the Geosoft GDB database on a daily basis. The aero magnetic data was corrected for diurnal variations by subtracting the observed magnetic base station deviations. The corrected magnetic line data from the survey was interpolated between survey lines using a random point gridding method to yield x-y grid values for a standard grid cell size of approximately 0.2 cm at the mapping scale. The Minimum Curvature algorithm was used to interpolate values onto a rectangular regular spaced grid.







